

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A server load balancing apparatus located in front of a plurality of servers connected to a plurality of clients through the Internet, the server load balancing apparatus comprising:

a processor coupled to a packet analyzing unit, the packet analyzing unit operates to determine whether a session label has been attached to a received packet, analyzing header information of the received packet to learn session information for the received packet without a session label, and attaching a Client-To-Server (C2S) session label to a header of the received packet;

a load balancing processing unit that operates to assign one of the servers to a session of the received packet without a session label attached in view of load balancing;

a session label switching unit that operates to hardware-switching the received packet with the C2S session label attached using only the C2S session label information without performing a packet analysis process or server assignment process;

a session managing unit for managing and maintaining relevant information and states of sessions requested by the clients; and

a session label managing unit for assigning the C2S session label, and withdrawing and managing session labels not in use,

wherein the load balancing apparatus uses Multi-Protocol Label Switching (MPLS) session labels and analyzes requests from the clients and distributes the requests among the servers, and

wherein the one of the servers increments the value a value of the C2S session label in the received packet by a predetermined number to generate a Server-To-Client (S2C) session label and transmits a response packet including the S2C session label to a requesting client , and wherein the requesting client decrements the value a value of the S2C session label by the predetermined number to generate the C2S session label and transmits a packet including the C2S session label to the one of the servers.

2. (Original) The server load balancing apparatus according to claim 1, wherein the packet analyzing unit comprises:

a session label inspecting unit for inspecting whether the session label has been attached to the received packet, transmitting the received packet to the session label switching unit to switch the received packet if the session label has been attached to the received packet, and transmitting the received packet to a packet contents analyzing unit if the session label is not attached to the received packet;

the packet contents analyzing unit for learning the session information by analyzing the header information of the received packet ranging from third to seventh layers of the received packet, inspecting whether a session of the received packet is a new session, transmitting the received packet of the new session to the load balancing processing unit to assign the server to the new session if the session is new, and transmitting the packet of an existing session to a predetermined server if the session is not new; and

a session label attaching unit for attaching the assigned session label to the header of the received packet.

3. (Original) The server load balancing apparatus according to claim 1, wherein the session label is an MPLS-based session label

4. (Original) The server load balancing apparatus according to claim 1, wherein the load balancing processing unit comprises:

a load balancing algorithm unit for determining a load balancing server using a specific algorithm in view of information including a round robin method, a minimally connected server, weights and response time from the server;

a server configuration/state managing unit for managing configurations and states of the servers by performing real time server state monitoring or configuration management; and

a service acceptance control unit for refusing a service request of the new session if the existing session is serviced.

5. (Original) The server load balancing apparatus according to claim 1, wherein the session label switching unit performs label switching with reference to a value of the session label attached to the header of the received packet, and a label switching table including information of line cards and ports through which the received packet is input/output.

6. (Original) The server load balancing apparatus according to claim 1, wherein the session managing unit recognizes start, determination and interruption of the session, and adds, deletes and changes relevant information in the session table.

7. (Previously Presented) The server load balancing apparatus according to claim 1, wherein the assignment of the session label is performed in such a way that the C2S session label is assigned an odd number and the S2C session label is assigned an even number obtained by adding 1 to the value of the C2S session label.

8. (Currently Amended) A server load balancing method using MPLS session labels, in which a plurality of clients are connected to a plurality of servers, and a server load balancing apparatus located in front of the plurality of the servers analyzes requests from the clients and distributes loads among the servers, comprising:

analyzing, at server load balancing apparatus, a header of a received packet and assigning a C2S session label when a requesting client requests service from the servers through the server load balancing apparatus and determining if a session has begun;

assigning, at server load balancing apparatus a specific server for servicing the session in view of load balancing, attaching the assigned C2S session label to the received packet, transmitting the received packet with the C2S session label attached to the server;

automatically assigning, at the server, an S2C session label, that is, an opposite direction session label, by incrementing the value of the C2S session label of the received packet by a predetermined number;

processing, at the server, the service request from the requesting client, attaching the assigned S2C session label to an response packet according to a result of the processing, and transmitting the response packet with the S2C session label to the server load balancing apparatus;

label switching, at server load balancing apparatus, the response packet to the client using the S2C session label;

automatically assigning, at the requesting client, the C2S session label, that is, another opposite direction session label to the response packet, by decrementing ~~the value~~a value of the S2C session label of the response packet by the predetermined number;

attaching, at the requesting client, a packet with the assigned C2S session label and transmitting the packet with the assigned C2S session label to the server load balancing apparatus when the requesting client transmits the packet to a destination server; and

label switching, at the server load balancing apparatus, the packet with the C2S session label attached to the destination server;

wherein the server load balancing apparatus determines the one of the servers for connection using information of the session label with respect to the packet with the session label attached.

9. (Original) The server load balancing method according to claim 8, wherein it is inspected whether the MPLS session label has been attached to the packet input into the server load balancing apparatus, and the packet with the MPLS session label attached is fast-switched using only information of the session label.

10. (Original) The server load balancing method according to claim 8, wherein it is inspected whether the MPLS session label has been attached to the packet input into the server load balancing apparatus, and only the header of the packet header without the session label attached is selectively analyzed.

11. (Previously Presented) The server load balancing method according to claim 8, wherein the assigning the specific server comprises:

determining whether to accept or refuse the session of only the packet without the session label attached.

12. (Original) The server load balancing method according to claim 8, wherein the server load balancing apparatus omits a function of performing mapping between a virtual IP address and an IP addresses of the server in such a way that the server attaches the virtual IP address to the header of the packet with the session label attached.

13. (Previously Presented) The server load balancing method according to claim 8, wherein the C2S session label is assigned an odd number, and the S2C session label is automatically assigned the value obtained by adding 1 to the value of the C2S session label.

14. (Previously Presented) The server load balancing method according to claim 8 or 13, wherein the assignment of the bi-directional session labels (S2S and S2C) is performed by automatically recognizing the value of the opposite directional label without using an additional protocol for assigning the session label to the packet in such a way the server and the client add 1 to and subtract 1 from the value of the session label that is attached to the packet received from an opposite party, respectively.

15. (Original) The server load balancing method according to claim 8, wherein the session label is attached to the header of the received packet according to a MPLS header configuration.

16. (New) A server load balancing apparatus using Multi-Protocol Label Switching (MPLS) session labels, the server load balancing apparatus located in front of a plurality of servers connected to a plurality of clients through the Internet, the server load balancing apparatus comprising:

a processor coupled to a packet analyzing unit, wherein the packet analyzing unit operates to determine whether a session label has been attached to a received packet, the session label including a Client-To-Server (C2S) session label value for packets transmitted from a requesting client to an assigned server, or a Server-To-Client (S2C) session label value for packets transmitted from the assigned server to the requesting client, wherein the packet analyzing unit further operates to:

in response to a determination that the session label has not been attached, analyze header information of the received packet to learn session information of the received packet, attach the session label including an assigned C2S session label value to a header of the received packet, and transmit the received packet to a load balancing processing unit; and

in response to a determination that the session label has been attached, transmit the received packet to a session label switching unit;

the load balancing processing unit to receive the received packet without the session label attached, and to assign one of the servers to a new session as the assigned server in view of load balancing of the servers;

the session label switching unit that operates to perform hardware-switching the received packet having the session label attached, using only the session label information without performing a packet analysis process or server assignment process;

a session managing unit for managing and maintaining relevant information and states of sessions requested by the clients; and

a session label managing unit for assigning the C2S session label value, and withdrawing and managing session labels not in use,

wherein, after the C2S session label value is assigned to the received packet of the new session, the same C2S session label value is encapsulated in additional packets of the new session from the requesting client, and, in the new session, a value different from the C2S session label value is encapsulated in response packets from the assigned server as the S2C session label value.

17. (New) A server load balancing method using Multi-Protocol Label Switching (MPLS) session labels, in which a plurality of clients are connected to a plurality of servers, and a server load balancing apparatus located in front of the plurality of the servers analyzes requests from the clients and distributes loads among the servers, the method comprising:

receiving a packet from a requesting client;

determining whether a session label has been attached to the received packet, the session label including a Client-To-Server (C2S) session label value for packets transmitted from the requesting client to an assigned server, or a Server-To-Client (S2C) session label value for response packets transmitted from the assigned server to the requesting client;

in response to a determination that the session label has not been attached, analyzing header information of the received packet to learn session information of the received packet, attaching the session label including an assigned C2S session label value to a header of the received packet, and transmitting the received packet to a load balancing processing unit;

in response to a determination that the session label has been attached, transmitting the received packet to a session label switching unit for label switching;

receiving, by the load balancing processing unit, the received packet without the session label attached and assigning one of the servers to a new session as the assigned server in view of load balancing of the servers;

label switching, by the session label switching unit, the received packet having the session label attached, using the C2S session label value in the session label;

label switching, by the session label switching unit, the response packets from the assigned server to the requesting client using the S2C session label value in the session label;

wherein a same C2S session label value is encapsulated in packets of the new session from the requesting client, and a same S2C session label value is encapsulated in packets of the new session from the assigned server, the S2C session label value being different from the C2S session label value.